

REMARKS

The Office Action dated June 20, 2003 has been received and carefully noted. The following remarks are submitted as a full and complete response thereto.

Claims 1-10 are pending in the above-cited application and have been examined. Claims 1, 2, 6 and 7 were rejected under 35 U.S.C. §103(a) as being unpatentable over *Nakazawa et al.* (U.S. Patent No. 5,948,200) in view of *Langhans* (U.S. Patent No. 4,378,480). Claims 3-5 and 8-10 were indicated in the Office Action as being allowable if rewritten in independent form.

The present invention is directed to a laser drilling method carried out by irradiating a workpiece with a laser beam from a laser oscillator. The laser beam is projected traveling through a polygon mirror, a mask having a mask pattern including a plurality of holes for defining a processing pattern, at least one galvano-mirror and a processing lens. The polygon mirror sweeps the laser beam so that it scans across the plurality of holes in the mask to thereby form a plurality of holes in the workpiece. The irradiation region of the laser beam onto the workpiece is shifted in one axis direction by the at least one galvano-mirror.

In claim 6, a laser drilling apparatus is recited, having a polygon mirror, a mask having a mask pattern including a plurality of holes for defining a processing pattern, at least one galvano-mirror and a processing lens. Those elements are arranged between a laser oscillator and the workpiece, with the laser beam being projected onto the workpiece through those components. The polygon mirror sweeps the laser beam so that

it scans across the plurality of holes in the mask to thereby form a plurality of holes in the workpiece and the irradiation region of the laser beam onto the workpiece is shifted in one axis direction by the at least one galvano-mirror. The additional embodiments are claimed in claims 2 and 7, wherein two galvano-mirrors are recited as producing translation of the irradiation region on the workpiece.

Nakazawa et al. is directed to a method and apparatus for forming holes in green ceramic sheets. A laser source (7), as illustrated in Fig. 4, produces a laser beam that passes through a mask (8), where the mask may have a plurality of holes (column 7, lines 31-35). A galvano-mirror (9) is used to direct the beam to contact points on the ceramic sheet and alternate embodiments provide for an XY table (57, Fig. 38), additional lenses (54) and a galvano-mirror having two degrees of freedom, to move the irradiation region orthogonally over the surface, as shown in Fig. 34.

The Office acknowledges that *Nakazawa et al.* fails to disclose the use of a polygon mirror as claimed in claims 1 and 6. Because of this deficiency, the Office also cites *Langhans*. *Langhans* is directed to an apparatus for optically chopping a laser beam into discrete light pulses. That apparatus utilizes a polygon mirror (12) to form the pulses, where the pulses are used to form perforations. Applicants respectfully traverse this rejection based on the following remarks.

Independent claim 1 recites, in part, that the “polygon mirror sweeps said laser beam so that said laser beam scans across the plurality of holes in the mask” to thereby form the plurality of holes into the workpiece. A similar limitation is also recited in

claim 6. In other words, the laser beam passes through the holes in the mask one by one. In such a manner, it is possible to widely scan through the use of a laser beam having a relatively small sectional size.

Nakazawa et al. never teaches or suggests the above-mentioned recitation. Although *Nakazawa et al.* arguably discloses that “if a plurality of holes are formed in the mask 8 and a plurality of laser beams simultaneously irradiate the magnetic green sheet 5, the period of time needed to form the through holes is reduced,” (see column 7, lines 31-34, emphasis added), this fails to teach or suggest that the laser beam scans the plurality of holes, in order, in the mask. With respect to *Nakazawa et al.*, it should be understood that the laser beam has a sectional size which can cover the plurality of holes in the mask. Namely, the laser beam simultaneously passes through all the holes in the mask. The sectional size of the laser beam has the limitation. Accordingly, the number of the laser beams simultaneously irradiated from the mask has also the limitation.

Although *Langhans* discloses the polygon mirror, the mask and the galvano-mirror are never disclosed. Furthermore, the polygon mirror is never used for scanning the laser beam in *Langhans*. Namely, the polygon mirror is used for optical chopping of the laser beam. In *Langhans*, if the laser beam is scanned by the polygon mirror, the laser beam is irradiated not only to the target position but also to the undesired position on the paper web 20. Such a chopping function is therefore quite different from the scan function of the present invention. Thus, even if the two references were somehow combined, their combination would not result in the present invention.

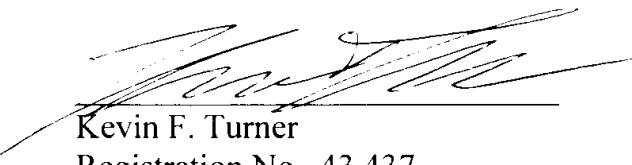
For the reasons mentioned above, *Nakazawa et al.* and *Langhans* are not properly combinable and Applicants respectfully assert that the rejection is improper. Accordingly, the present invention claimed in independent claims 1 and 6 is respectfully asserted to be patentable over the cited prior art references. Dependent claims 2 and 7 would likewise also be patentable because these claims depend from patentable independent claims 1 and 6, respectively.

Additionally, with respect to the rejection of claims 2 and 7, while the Office alleges that *Nakazawa et al.* teaches the production of a plurality of holes by moving the irradiation region (Fig. 34) in orthogonal directions, this is achieved either through motion of the XY table (35, Fig. 30) or through the use of a galvano-mirror having two degrees of freedom (46, Fig. 36). The Office Action has failed to show the use of two galvano-mirrors would be obvious in view of the disclosures of *Nakazawa et al.* and *Langhans* or that the benefits of having two galvano-mirrors would be matched or superceded through the use of a single galvano-mirror, as disclosed in *Nakazawa et al.* As such, for this additional reason, Applicants respectfully traverse the rejection of claims 2 and 7 and respectfully request reconsideration and withdrawal of the rejection of those claims.

If for any reason the Examiner determines that the application is not now in condition for allowance, it is respectfully requested that the Examiner contact, by telephone, the applicant's undersigned attorney at the indicated telephone number to arrange for an interview to expedite the disposition of this application.

In the event this paper is not being timely filed, the applicant respectfully petitions for an appropriate extension of time. Any fees for such an extension together with any additional fees may be charged to Counsel's Deposit Account 50-2222.

Respectfully submitted,



Kevin F. Turner
Registration No. 43,437

Customer No. 32294

SQUIRE, SANDERS & DEMPSEY LLP
14TH Floor
8000 Towers Crescent Drive
Tysons Corner, Virginia 22182-2700
Telephone: 703-720-7800
Fax: 703-720-7802

KFT:lls